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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/497,320	02/03/2000	Ahmad Ghaemmaghani	E0545/1516P	7350

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EXAMINER

DIAZ, JOSE R

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 05/16/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/497,320

Applicant(s)

GHAEMMAGHAMI ET AL.

Examiner

José R. Díaz

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 March 2002.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4,5,7,8,11,12 and 14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4,5,7,8,11,12 and 14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 103

➤ The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

➤ Claims 1, 4-5, 7-8, 11-12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Specification in view of Hook et al. (US Patent No. 6,083,794).

Regarding claims 1, 7-8 and 14, Applicant discloses a well-known method for providing a halo implant in a semiconductor device (see pages 1-4 of Applicant's Specification) comprising the steps of: providing a DUV photoresist (213) and a halo implant (202) (see Figure 1). However, Applicant states that the art fails to teach a halo implant process wherein the thickness of the photoresist (213) is reduced. Hook et al.

disclose that is well known in the art to provide a thin photoresist (18) by reducing the thickness (h). For instance see Figure 2, wherein Hook et al. teach that the reduction of the thickness (h) is given by:

$$(1) h = d \tan \theta$$

Therefore, it would have been obvious to one having ordinary skill in the art at the same time the invention was made to modify Applicant's Specification to include a thin photoresist. The ordinary artisan would have been motivated to modify Applicant's Specification in the manner described above for at least the purpose of making multiple asymmetrical devices on a single common substrate at different orthogonal orientations.

Furthermore, Applicant discloses that the art fails to teach a photoresist that covers portions of source and drain regions. However, Hook et al. disclose that is well known in the art to place the photoresist at any point between the gate and a maximum distance (d), in which the source/drain regions are formed (see Figures 2-4). Therefore, it would have been obvious to one having ordinary skill in the art at the same time the invention was made to modify Applicant's Specification to include the steps of placing the photoresist on portions of the source/drain region. The ordinary artisan would have been motivated to modify Applicant's Specification in the manner described above for at least the purpose of making multiple asymmetrical devices on a single common substrate at different orthogonal orientations.

In addition, Applicant discloses that the art fails to teach a photoresist having a thickness of about 0.1-0.2 μ m. However, Hook et al. disclose the general conditions for a halo implant, which are given by the equation (1). Thus, it would have been obvious to

one of ordinary skill in the art to reduce the thickness of the photoresist of about 0.1-0.2 μ m, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Regarding claims 4 and 11, Applicant discloses that is well known in the art to form the halo region by implanting ions (202) at a 45° angle (see Figure 2)

Regarding claims 5 and 12, Applicant discloses that is well known in the art to form LDD regions prior to implant the halo region (see page 1, lines 6-12).

➤ Claims 1, 4-5, 7-8, 11-12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Specification in view of Chittipeddi et al. (US Patent No. 5,045,486).

Regarding claims 1, 7-8 and 14, Applicant discloses a well-known method for providing a halo implant in a semiconductor device (see pages 1-4 of Applicant's Specification) comprising the steps of: providing a DUV photoresist (213) and forming a halo region by a tilt-angle ion implantation (202) (see Figure 1). However, Applicant states that the art fails to teach a tilt-angle implant process wherein the thickness of the photoresist mask (213) is reduced. Chittipeddi et al. teach that is well known in the art to reduce the thickness of the photoresist mask during a tilt-angle implant process (see col. 5, lines 12-18).). Therefore, it would have been obvious to one having ordinary skill in the art at the same time the invention was made to modify Applicant's Specification to include the steps of reducing the thickness of the photoresist to form a thin photoresist.

The ordinary artisan would have been motivated to modify Applicant's Specification in the manner described above for at least the purpose of reducing shadowing.

Furthermore, Applicant discloses that the art fails to teach a photoresist having a thickness of about 0.1-0.2 μ m. However, Chittipeddi et al. teach that is well known in the art to reduce the thickness of the photoresist to about 0.1-0.2 μ m (see col. 5, lines 14-16). Therefore, it would have been obvious to one having ordinary skill in the art at the same time the invention was made to modify Applicant's Specification to include a thin photoresist of about 0.1-0.2 μ m. The ordinary artisan would have been motivated to modify Applicant's Specification in the manner described above for at least the purpose of reducing shadowing.

Regarding claims 4 and 11, Applicant discloses that is well known in the art to form the halo region by implanting ions (202) at a tilt-angle of 45° (see Figure 2)

Regarding claims 5 and 12, Applicant discloses that is well known in the art to form LDD regions prior to implant the halo region (see page 1, lines 6-12).

Response to Arguments

➤ Applicant's arguments filed March 1, 2002 have been fully considered but they are not persuasive. Applicant argues that the rejection under 35 USC § 103 is improper since the combination of references fail to teach or suggest the claimed limitations. However, the Examiner disagrees. With regards to the rejection based on the combination of Applicant's Background of the Invention and Hook et al., the reference Hook et al. cures the deficiencies of the Applicant's Background of the Invention. For example, Hook et al. provide a general teaching relating the angle of

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implantation (θ), the thickness of the photoresist (h) and the distance between the photoresist and the gate electrode (d) (see equation 1). Applicant states that this relation (e.g. equation 1) teaches away from the Background of the Invention since the relation fails to anticipate an alignment accuracy of the mask within $0.2 \mu\text{m}$ (see page 8, lines 1-2 of the Remarks). However, this interpretation is incorrect because the equation works for the proposed dimensions. First, Hook et al. teaches that the reduction of the thickness (h) is given by:

$$(1) h = d \tan\theta$$

Second, Hook et al. teaches that the alignment accuracy of the mask is "one half of the width of the gate (l) plus the maximum distance (d)" (see col. 3, lines 25-27 and Fig. 2), in other word:

$$(2) \text{alignment accuracy} = (l + d) / 2$$

Thus,

$$(3) \text{alignment accuracy} = [l + (h/\tan\theta)] / 2$$

If the equation 3 is solved using the claimed dimensions (e.g. $h = 0.1 - 0.2 \mu\text{m}$; and $\theta = 45^\circ$) and the gate width for "today's technology standards" (e.g. $l = 0.2 \mu\text{m}$), as stated in the remarks, the alignment accuracy is at least $0.2 \mu\text{m}$, which agrees with the alignment accuracy of the mask for "today's technology standards", as argued by Applicant. Thus, the reference Hook et al. does not teach away as argued by Applicant.

Moreover, Applicant states that the reference Hook et al. fails to teach the limitation "covering a substantial amount of an active area comprising a source region and a drain region with the thin photoresist layer" (see page 8 of the remarks). However,

the Examiner disagrees. First, Applicant is advised that during patent examination, the pending claims must be "given the broadest reasonable interpretation consistent with the specification" (see MPEP 2111). In view of that, consider Figures 2-3, column 5, lines 1-3 and column 6, lines 7-11 of Hook et al., wherein the mask is formed either on the upper surface of the gate electrode and/or one of side the gate electrode. One of ordinary skills in the art recognizes that such a gate electrode covers a portion of an active region comprises of source, drain and channel regions. Thus, broadly speaking the mask, which is at least over the gate electrode covers a substantial amount of the active area.

With regards to the reference Chittipeddi et al. Applicant's states that the reference fails to teach a thin photoresist used as a mask for the halo implant. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Applicant's Background of the Invention clearly teaches the claimed invention except for the used of a thin photoresist layer to form a halo region. However, Applicant acknowledges that typically, "the same mask lightly doped drain) (LDD) is utilized for the halo implant since the halo implant takes place after the LDD implant" (see page 1, lines 8-9 of Applicant's Background of the Invention). Chittipeddi et al. teach that is well known in the art to reduce the thickness of the photoresist layer prior to implant the LDD regions (see col. 5, lines 5-17). Thus, the combination of references anticipates the claimed limitation

since the combination clearly teaches that is possible to use the same thin photoresist layer, used during the implantation of the LDD regions, to form the halo region. Therefore, Applicant's arguments are not persuasive in view of the remarks described above.

Conclusion

➤ The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Sultan (US Pat. No. 5,970,353) discloses that is well known in the art to use thin photoresist layer (e.g. 1 μ m) to form the LDD regions (see col. 5, lines 25-34). Krivokapic et al. (US Pat. No. 6,320,236 B1) disclose asymmetric channel regions.

➤ **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.


Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to José R. Díaz whose telephone number is (703) 308-6078. The examiner can normally be reached on 9:00 - 5:00 Monday, Tuesday, Thursday and Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 746-3891 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JRD
May 10, 2002


EDDIE LEE
SUPERVISORY PATENT EXAMINER
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